T 89: Theorie: Higgs

Zeit: Donnerstag 16:00–18:15 Raum: S16

T 89.1 Do 16:00 S16

Probing the Higgs sector within non-linear Effective Field Theory — •Matteo Capozi — MPI for Physics, Munich, Germany

We discuss the effects of anomalous couplings in the Higgs sector arising in a non-linear Effective Field Theory, combined with full NLO QCD corrections.

We analyze how variations of the anomalous couplings can modify the behavior of total and differential cross sections for processes involving the Higgs boson and how they interplay with the NLO corrections.

T 89.2 Do 16:15 S16

Next-to-next-to-leading order real corrections to Higgs boson pair production in the large top mass limit — Joshua Davies, •Florian Herren, Go Mishima, and Matthias Steinhauser — Institut für Theoretische Teilchenphysik, Karlsruhe Institute of Technology (KIT)

Higgs boson pair production allows to probe the trilinear Higgs self-interaction of the scalar potential of the Standard Model. Whereas at next-to-leading order (NLO) exact results are available one has to rely on approximations at NNLO.

In this talk we will present analytic results for NNLO real corrections in the large top quark mass limit and include several $1/m_t$ terms.

T 89.3 Do 16:30 S16

NLO QCD-Korrekturen zur Higgspaarproduktion via Gluonfusion — Julien Baglio[4], Francisco Campanario[1,3], •Seraina Glaus[1], Margarete Mühlleitner[1], Michael Spira[2] und Juraj Streicher[4] — [1]Institute for Theoretical Physics, Karlsruhe Institute of Technology, D-76128 Karlsruhe, German — [2]Theory Group LTP, Paul Scherrer Institut, CH-5232 Villigen PSI, Switzerland — [3]Theory Division, IFIC, University of Valencia-CSIC, E-46980 Paterna, Valencia, Spain — [4]Institute for Theoretical Physics, Eberhard Karls Universitaet Tuebingen, Auf der Morgenstelle 14, D-72076 Tuebingen, Germany

Die gemessenen Eigenschaften des am LHC entdeckten Higgsbosons lassen im Rahmen der Unsicherheiten die Zuordnungen zu anderen erweiterten Modellen zu. Bei der Bestimmung der Eigenschaften dieses Teilchens spielt die Rekonstruktion des Higgspotentials eine zentrale Rolle, um zu prüfen, ob dieses Teilchen die elektroschwache Symmetriebrechung erzeugt. Dafür muss die Selbstwechselwirkungsstärke zwischen Higgsbosonen direkt bestimmt werden, was für die trilineare Kopplung in der Higgspaaarproduktion möglich ist. Der dominante Prozess ist die loop-induzierte Gluonfusion. Die Methodik zur Berechnung der NLO QCD-Korrekturen mit voller Topmassen-Abhängigkeit im Rahmen des Standardmodells und möglichen Erweiterungen wird vorgestellt. Resultate für den differenziellen und totalen Wirkungsquerschnitt werden gezeigt. Insbesondere werden die Unsicherheiten, induziert durch die verbleibende Schemen- und Skalenabhängigkeit, sowie die PDF+α_s-Unsicherheiten präsentiert.

T 89.4 Do 16:45 S16

Double Higgs boson production at NLO in the high-energy limit — Joshua Davies, Go Mishima, Matthias Steinhauser, and •David Wellmann — Karlsruher Institut für Technologie (KIT), Karlsruhe, Deutschland

Double Higgs boson production via gluon fusion is a loop-induced process. Determining the form factors at next-to-leading order requires the evaluation of massive two-loop Feynman diagrams and involves multiple scales. We tackle this problem in the high-energy limit where we obtain analytic results for both planar and non-planar master integrals and therefore also for the form factors. In this talk, the results and the kinematic region in which they are valid, are discussed and compared against numerical calculations.

T 89.5 Do 17:00 S16

Automatised NLO matching between two scalar sectors — •Martin Gabelmann, Margarete Mühlleitner, and Florian Staub — Karlsruher Institut für Technologie

Null results in searches for new physics at the LHC support the possibility that a large separation between the scale of new physics and the electroweak scale exists. Nevertheless, there are still observables in this scenario, in particular the Higgs mass, that are sensitive to the properties of theories beyond the Standard Model. In order to obtain reliable predictions for a model that involves very heavy degrees of freedom, the precise matching to an effective theory is necessary. I present an extension of the Mathematica package SARAH which is able to perform the matching of the scalar sector between two renormalizable gauge theories at the full one-loop level. In addition to comparisons with known results that concern a Standard Model effective theory, I discuss the matching of a singlet extended Minimal Supersymmetric Standard Model onto a low energy theory with an extended scalar and fermion sector.

T 89.6 Do 17:15 S16

Thermal Goldstone bosons and the calculation of the thermal Higgs potential — •Sinan Zeissner — TU-Dortmund

I discuss an intuitive way of deriving a general form of the effective Higgs potential in the presence of matter and focus in particular on the question if thermal contributions of the Goldstone boson modes have to be taken into account for the calculation.

T 89.7 Do 17:30 S16

Wilson coefficients for Higgs boson production to $\mathcal{O}(\alpha_s^4)$ — •Marvin Gerlach, Florian Herren, and Matthias Steinhauser — Institut für Theoretische Teilchenphysik, Karlsruhe Institute of Technology (KIT), Wolfgang-Gaede Straße 1, 76128 Karlsruhe, Germany

The high luminosity phase at the LHC may reveal new insides to the Higgs boson self coupling. Therefore, the importance of theory predictions is obvious. A comprehensive tool to include QCD corrections in Higgs physics is to use Higgs Effective Field Theory (HEFT), in which the top quark mass m_t is sent to infinity. For this theory we compute the effective couplings of one and two Higgs bosons to gluons to N^{3}LO in QCD in a diagrammatic way. The resulting Wilson coefficients are crucial for gluon fusion processes, the most important production channels of Higgs bosons at the LHC.

T 89.8 Do 17:45 S16

Higher-Order Corrections to 2HDM Higgs Decays with 2HDECAY — •Marcel Krause[1], Margarete Mühlleitner[1], and Michael Spira[2] — [1]Institute for Theoretical Physics, Karlsruhe Institute of Technology, Wolfgang-Gaede-Str. 1, 76131 Karlsruhe, Germany — [2]Paul Scherrer Institute, CH-5232 Villigen PSI, Switzerland

Among the simplest extensions of the Standard Model (SM) Higgs sector is the Two-Higgs-Doublet Model (2HDM). In order to discern subtle new physics effects in the Higgs sector from the SM background precise theoretical predictions for Higgs observables are required. We present the program package 2HDECAY which allows for the calculation of branching ratios and partial decay widths of all Higgs bosons of a general CP-conserving 2HDM including higher-order corrections. The tool combines the state-of-the-art quantum chromodynamics (QCD) corrections implemented in HDECAY with the full electroweak one-loop corrections to all non-loop-induced two-body on-shell Higgs decays in the 2HDM. The renormalization of the electroweak sector is performed mostly in an on-shell scheme. Exceptions are the $\overline{\text{MS}}$ renormalized $\mathbb{Z}_2$-symmetry-breaking scale m_{12}^2 and the scalar mixing angles α and β for the CP-even and CP-odd/charged Higgs bosons, for which several different renormalization schemes are implemented. 2HDECAY allows for a consistent comparison of the partial decay widths and branching ratios obtained from the different renormalization schemes of the mixing angles which enables an estimate of the remaining theoretical error due to missing higher-order corrections. 2HDECAY can be obtained from https://github.com/marcel-krause/2HDECAY.

T 89.9 Do 18:00 S16

The light MSSM Higgs mass: merging fixed order and resummation at three loop — Robert V. Harlander, •Jonas Klappert, Lars-Thorben Moos, Daniel Ochoa, and Alexander Voigt — RWTH Aachen University

Results for the light Higgs mass in the MSSM up to three-loop order including the corresponding uncertainties are discussed. Since experimental exclusions push the threshold of masses of potential SUSY partner particles to the TeV scale, it is necessary to resum terms which are enhanced by logarithms of the SUSY scale. In this talk, we present a

combined technique based on a diagrammatic fixed-order and an EFT approach to reduce the origin of the individual uncertainties and to obtain a reliable result for the light Higgs mass. All results are publicly available in the Himalaya library.